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1942

Announcement of the

College of William and Mary and Commission of Fisheries in Virginia

Virginia Fisheries Laboratory

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Teaching and Research Programs in Aquatic Biology

Official Publication of the College of William and Mary in Virginia

Williamsburg, Virginia
June, 1942

Calendar 1942 Summer Session

1. First Term.....June 15-August 7
   (Normal load, 9 semester hours)

   Registration.....Monday, June 15

   Final examinations.....Friday, August 7

   First 32-day period ends.....Tuesday, July 21

2. Second Term.....August 8-September 12
   (Normal load, 6 semester hours)

   Registration.....Friday, August 7

   Final examinations.....Saturday, September 12

FIELD TRIPS

York River to study estuarine conditions.....June 20

Queens Creek to observe rac oysters.....June 27

Fox Hill to study beds of hard-shelled clams.....July 11

Hampton Roads to observe the commercial crab fishery....July 18

York River to study oyster rocks.....July 25

Intertidal Communities on Mobjack Bay to study their composition and distribution.....August 1

Study of Mussel Communities at the Carmine Island Experimental Station.....August 8

Study of Mussel Communities at the Wachapreague Experimental Station on the Seaside.....August 15

Virginia Fisheries Laboratory

OFFICERS OF ADMINISTRATION

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CHARLES M. LANKFORD, JR. ..*Commissioner of Fisheries of Virginia*
DONALD W. DAVIS.....*Head, Department of Biology*
CURTIS L. NEWCOMBE.....*Director of the Laboratory*

STAFF

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Associate Professor of Biology
JOHN H. LOCHHEAD, Ph.D. .....*Assistant Biologist*
Lecturer in Biology
WINSTON MENZEL, B.S. .....*Assistant Biologist*
Instructor in Biology
COIT M. COKER, M.A. .....*Assistant Biologist*
B. B. SHEPHERD, M.A. .....*Research Assistant and Demonstrator*
JOHN C. STRICKLAND, JR., M.A. ....*Research Assistant*
Graduate Assistant
ROSALIE ROGERS.....*Laboratory Assistant*

ASSOCIATE STAFF

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Assistant Professor of Chemistry
ROY P. ASH, Ph.D. .....*Research Associate*
Assistant Professor of Biology
ALBERT L. DELISLE, Ph.D. .....*Research Associate*
Assistant Professor of Biology
SEWELL H. HOPKINS, Ph.D. .....*Research Associate*
Professor of Biology, Texas A. & M. College

HERBERT A. DRUMMOND.....*In Command of the "Agnes Hope"*
L. T. KILLMAN.....*Engineer of the "Agnes Hope"*

Washington Hall, Housing the Department of Biology, From the Sunken Garden

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Ivey F. Lewis, *Miller Professor of Biology,* University of Virginia.

S. O. Mast, *Professor of Zoology,* The Johns Hopkins University.

R. L. Miles, J. H. Miles & Company, Norfolk, Virginia.

Thurlow C. Nelson, *Professor of Zoology,* Rutgers University.

Fishing a Pound Net on Chesapeake Bay

CARL H. NOLTING, *Chairman,* Virginia Commission of Game and Inland Fisheries.

I. C. RIGGIN, *Commissioner,* Virginia Board of Health.

N. CLARENCE SMITH, *Commissioner,* Virginia Commission of Conservation.

MARCELLUS H. STOW, *President-elect,* Virginia Academy of Science.

THOMAS B. SYMONS, *Dean,* College of Agriculture, University of Maryland.

WADE WALKER, J. C. Walker Brothers, Inc., Willis Wharf.

I. D. WILSON, *Professor of Biology,* Virginia Polytechnic Institute, Blacksburg.

A. J. WIMBROW, A. J. Wimbrow & Brother, Chincoteague.

Virginia Fisheries Laboratory

"If the seasons of husbandry be not interfered with,
The grain will be more than can be eaten,
If close nets are not allowed to enter the pools and ponds,
The fish and turtles will be more than can be consumed."
—by the Chinese philosopher, Mencius, about 325 B. C.

The Virginia Fisheries Laboratory conducts investigations and gives instruction in aquatic biology and conservation. The research work includes studies on methods of increasing the yield of the State's tidewater fisheries and of determining how large a catch certain of our fisheries may be expected to maintain without endangering the future supply. The program calls for practical studies on the combinations of physical, chemical, and biological conditions determining variations in abundance, rates of growth, survival and reproductive habits of commercial species. Studies are made on the relative values of different cultural practices and regulatory measures. Attention is given to life histories and migrations of commercial animals and predatory organisms.

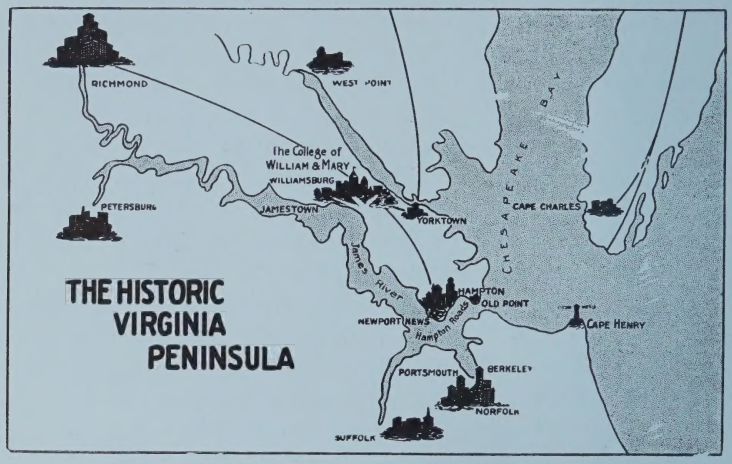
Educationally, the Laboratory provides a center for the dissemination of facts about the nutritional value of seafoods and their economic importance to community welfare. Courses of instruction are offered throughout the year in aquatic biology and related fields. By means of laboratory and field study, students of aquatic biology are trained to apply commerical methods of cultivating and utilizing seafood products in the best interests of conservation. As an extension service, the Laboratory sends an educational exhibit of the biology of Virginia fisheries to about forty State high schools each year, and provides certain descriptive pamphlets on the anatomy and life history of local aquatic animals. The summer courses include some designed to meet the needs of high school teachers of biology.

LOCATION

The Laboratory is located at Williamsburg and a station for field work is maintained at Yorktown. Williamsburg and Yorktown, with Jamestown the cradle of Anglo-Saxon civilization in America, are located on the peninsula of Virginia, a section

rich in memories of a pioneer culture. Williamsburg has a population of about 4,000 and is situated six miles from the James River at Jamestown and 15 miles from Yorktown on the York. The College of William and Mary in Virginia was founded here in 1693, and shortly thereafter (1699) Williamsburg became the Colonial Capital. During the last decade, the historic city of the middle 18th century has been restored and it is now the most extensive and most perfect work of restoration in America. Yorktown, with a population of about 500, is situated within 7 miles of the deeper waters of the Chesapeake Bay. The Virginia Fisheries Laboratory is thus within easy reach of the less saline waters of the James and the denser waters of the York, and is within short cruising range of the great Chesapeake Bay and oceanic conditions beyond Capes Charles and Henry. Few locations rival this region in respect to range and types of water conditions and the consequent varieties of animals and plants. The historic and scenic beauties add to its attractiveness as a place in which to carry on aquatic studies.

Digging for Clams



"Heaven and Earth never agreed better
to frame a place for man's habitation."
—*by Captain John Smith.*

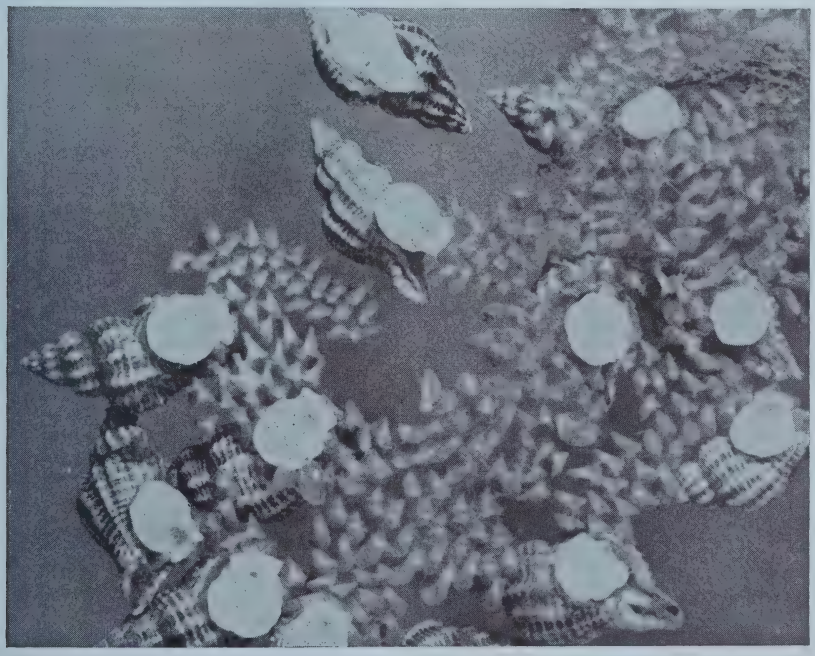
THE TEACHING PROGRAM

The general program in Aquatic Biology presented on pages 20 and 21 offers to undergraduate students an opportunity for getting sufficient training in applied biology to qualify for a position or to prepare for graduate study. Students who have satisfactorily completed their undergraduate requirements may candidate for graduate study in Aquatic Biology leading toward the degree of Master of Arts. Candidates for this degree are encouraged to spend one summer in residence for the purpose of gaining an adequate amount of field experience with special reference to their thesis work, and also, to permit their taking Biology 443—Aquatic Biology and Conservation. In the summer session, courses numbered between 300 and 500 are for advanced undergraduates and graduates; those numbered 500 and above are for students having graduate standing. A student may enroll during the first 32 days, ending July 21st, carrying a normal load of six semester hours. Those conducting research may continue during the succeeding weeks and receive credit commensurate with their work. Students who require only one course in the general field of biology may, if desired, select additional work

in other departments in accordance with their special needs. Summer courses in the Aquatic Biology program carry credit toward the A.B., B.S., and M.A. degrees and toward teachers' certificates.

Special encouragement and assistance are given to high school teachers of Virginia to aid them in interesting their students in the biology and preservation of local forms. Those who wish to do graduate work in this field may, during summer residence, complete requirements for the degree of Master of Arts.

The teaching program during both winter and summer emphasizes the broad aspects of conservation and fishery biology, much time being spent out-of-doors. Biology 443 provides special training in the essentials of field study. The field observations include the identification of different biotic communities, including the characteristic animals and plants of which they are composed; the study of local marine forms in the Chesapeake Bay; and, also, the biology of important commercial forms upon which



Screwborers and Their Egg Capsules

the fishery industries of the Chesapeake Bay depend. Biology 342 is offered to advanced undergraduate and graduate students who wish to acquire a knowledge of the more important plant groups and methods of identifying them. This course is designed mainly for students majoring in biology and for high school teachers who are interested in the local flora.

The educational program for high schools of the State will be continued and enlarged during the year. The Laboratory's exhibit on the biology of Virginia fisheries will be sent to over fifty schools, and a limited amount of demonstration material on the fisheries will be furnished to the school laboratories where the exhibit is shown. A motion picture film in color to be shown in each school presents the anatomy and early life history stages of the oyster, crab, and mussel and also methods of catch employed by the industry.

THE RESEARCH PROGRAM

The research work of the Laboratory is devoted primarily to life history studies of the crab and ribbed mussel; natural and semi-artificial methods of growing oysters and mussels; methods of controlling the screwborer, the worst enemy of the oyster in Virginia waters; and statistical field methods for determining the extent of seasonal and annual variations in the crab population of the lower bay. An effort is being made to improve the type of catch records obtained by the several fisheries.

Blue crab investigations during the summer will include experiments on the hatching of eggs and rearing of larvae under laboratory and natural conditions. With the conservation department of the Commission of Fisheries, studies will be made of the conditions under which crabs shed on the commercial floats, aiming to reduce the current mortality. Steps are being taken to improve the present system of collecting records on crab catches in Virginia waters, so as to provide a sound basis for immediate action when such is desirable for preserving a normal production level.

The screwborer will be studied in an effort to reduce the present number and to prevent their spreading to uninfected oyster beds. Laboratory and field experiments seeking better practical measures of screwborer control will be conducted as a

Trot Line Crab Fisherman in Action

part of the Commission's comprehensive program for the extermination of this predator.

The Laboratory will continue present studies on the populations of the ribbed mussel in Virginia waters. On account of the high provitamin potency of this shellfish, extensive life history, growth and propagation experiments are being conducted in Chesapeake waters and on the seaside of the eastern shore.

FACILITIES FOR FIELD AND LABORATORY STUDY

The Virginia Fisheries Laboratory is well located to function as a center for the investigation of tidewater problems in fishery biology. It is beside typical estuarine waters of lower Chesapeake Bay and within easy reach of off-shore oceanic conditions. The variety of gradients in respect to physical and chemical factors and the accompanying animal and plant populations occupying strata of rapidly changing conditions, present a series of intriguing problems to the naturalist and to the experimentalist. The "Agnes Hope", a 45-foot motor boat, is used for off-shore studies. This boat carries an outboard motor boat for studies in shallow

areas and facilities for limited types of physical and chemical determinations. Standard oceanographic sampling equipment for studying plankton populations, submarine illumination, and nutrient salts is carried. A smaller power boat is used for local studies, and routine river collecting is done in an outboard motor boat.

The field station at Yorktown serves for experimental studies, chiefly those which require running salt water. It is equipped with gas and electricity, running salt and fresh water, and, also, numerous large and small aquaria. Arrangements are made for the provision of additional supplies when needed from laboratories in Williamsburg.

Field work of the teaching program, conducted mainly in Williamsburg, is done on the nearby rivers and Bay and in the wildlife sanctuary called Matoaka Park, that adjoins the College campus. This nature center contains 1,200 acres of natural scenic attraction surrounding the waters of Lake Matoaka. During the summer, field trips are taken to fish and crab packing centers on the Bay in order that students may learn how the Bay products of commerce are handled. An excursion to the Laboratory's shellfish experimental station at Wachapreague on the Seaside of the eastern shore is contemplated during the summer of 1942.

Research facilities are provided in the scientific departments of the College. These include standard histological equipment, temperature control units, spectrophotometers for colorimetric work, a submarine photometer, and standard chemicals.

The College library is well supplied with standard works on Biology. Certain periodicals not available on the campus may be borrowed directly from the library of the United States Fish and Wildlife Service in Washington, or through the inter-library loan service.

FAUNA OF THE REGION

The variety of animal life in the estuarine waters of the lower Bay is expectedly large. Typical oceanic forms are present on the sea-side while brackish water organisms characterize the estuarine waters of the Bay. Local invertebrates for taxonomic, embryological and experimental study include *Microciona*,

Thuiaria, Bougainvillia, Hydractinia, Nemopsis, Dactylometra, Mnemiopsis, Pleurobrachia, Sagitta, Bugula, Alcyonidium, Leoidonotus, Polydora, Nereis, Arenicola, Cerebratulus, Acartia, Calanus, Balanus, Corophium, Batea, Caprella, Erichthonium, Idothea, Neomysis, Chloridella, Callinectes, Palaemonetes, Crago, Panopeus, Eurypanopeus, Uca, Libinia, Limulus, Asterias, Echinarachnius, Thyone, Arbacia, Littorina, Nassarius, Venus, Ostrea, Mya, and *Volsella.* Among the lower chordates, *Balanoglossus,* and *Molgula* occur. For information on the fishes occurring in Chesapeake Bay reference is made to "The Fishes of Chesapeake Bay" by Hildebrand and Schroeder.

In view of the different salinity gradients ranging from oceanic to fresh water conditions of the upper James and York rivers or of the upper reaches of the Chesapeake Bay, many interesting phenomena of distribution occur. They present numerous problems which need study.

Collecting on Chesapeake Bay

RESEARCH ACCOMMODATIONS FOR GUEST INVESTIGATORS

Guest investigators may be admitted to the Laboratory and given use of available facilities for their research. They should send to the Director a statement concerning their proposed research problem and the equipment that will be required. Persons unknown to the Director should submit with their application a statement of their qualifications and references.

ADMISSION

Students should consult the Annual College Catalogue or the Bulletin of the Summer Session for information regarding admission. Those desiring to take one or more of the courses offered by the Laboratory should communicate with the Dean of the Summer School relative to credentials for admission, and to the Director of the Laboratory for information about the courses and problem work desired.

EXPENSES FOR SUMMER SESSION

Living Expenses: Students enrolling for the first period of 32 days ending July 21st, will pay the same fees as those for the second term. Room rent ranges from $2.00 to $3.00 per week. Board in the College Cafeteria may be secured for from $6.00 to $8.00.

	Virginia Teachers		Other Virginia Students		Students from Other States	
	First Term	Second Term	First Term	Second Term	First Term	Second Term
Matriculation	$ 22.50	$ 15.00	$ 22.50	$ 15.00	$ 22.50	$ 15.00
Tuition			15.00	10.00	30.00	20.00
Medical and Recreation Fee	.50	.50	.50	.50	.50	.50

The term *Virginia teachers* applies to those teachers who taught in the public schools of Virginia during the past session, and to those whose last teaching was in the public schools of Virginia.

Nine semester-hour credits for the first term and six semester-hour credits for the second term are considered a normal load. The privilege of taking additional work requires special permission from the director of the summer session. For each two semester-hour course carried in addition to the normal load, a fee of $5.00 will be charged and for each three semester-hour course, a fee of $7.50 will be charged. In no case should a student take over twelve semester hours during the first term or eight semester hours during the second term.

Additional Fees: A laboratory fee of $5.00 is charged for each three or four semester-hour course in biology, physics and chemistry.

The College runs a first class laundry where students may receive laundry service for $2.00 for three weeks, $4.00 for six weeks, $6.00 for nine weeks, and $9.00 for thirteen weeks.

TRANSPORTATION

Williamsburg and Yorktown may be reached by bus or rail from Richmond. Baltimore boats stop at Yorktown. A schedule may be obtained by addressing the Chesapeake Steamship Company, Yorktown.

CURRICULUM FOR STUDENTS

Concentrating in Aquatic Biology

Students of Aquatic Biology need training in the basic sciences. The sequence below meets this consideration and offers students of Arts and Sciences a course of study that will equip them to apply their undergraduate training in natural history, wildlife management and conservation, fishery biology, and related fields. Also, it provides a scientific background for post-graduate study in one or more special branches of biology.

Freshman Year	Semester Credits	
	First	*Second*
English 100	3	3
Mathematics 101-102	3	3
Biology 100	5	5
Chemistry 100	5	5
Physical Ed. 101-102	1	1
	17	17

Sophomore Year	Semester Credits	
	First	*Second*
*English	3	3
Chemistry 201-202	4	4
†Biology 201-304	4	4
French or German	3	3
Physical Ed. 201-202	1	1
	15	15

Junior Year		
Biology 315-316	4	4
Economics, or Government, or History	3	3
French or German	3	3
Physics 101-102	5	5
	15	15

Senior Year		
Biology 405, 406	4	4
Biology 307, 312	3	4
Economics, or Government, or History	3	3
French or German	3	3
Electives (to make a total of 124)	2	1
	15	15

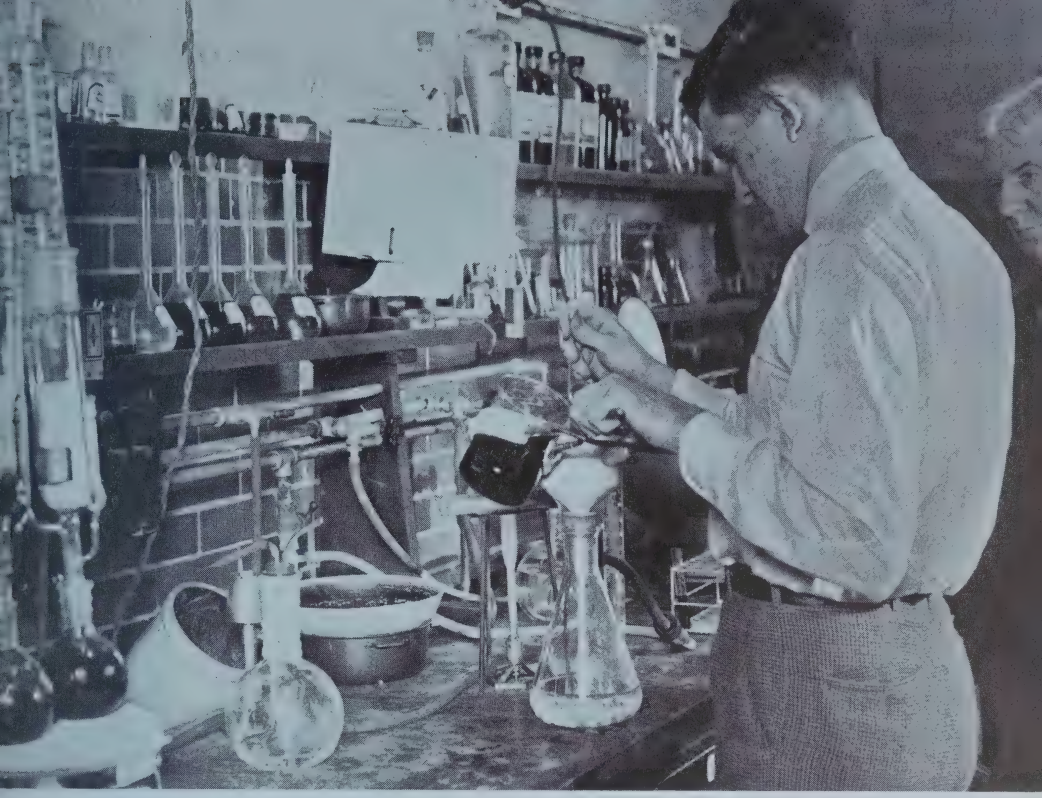
*Further specifications of requirements in departments where numbered courses are not here indicated and the description of the numbered courses in departments other than Biology (which see below) are given in the annual College catalogue supplied on request by the Registrar, College of William and Mary, Williamsburg, Virginia.

†Graduate credit may be received for three and four hundred courses with consent of the Head of the Department of Biology.

REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

The College of William and Mary offers the degree of Master of Arts to students majoring in Aquatic Biology who have creditably met the requirements stated below:

Entrance: The applicant for the Master's degree in Aquatic Biology must have completed the requirement for a bachelor's degree in an institution of approved standing; and must have made a quality point average of 4.5 or its equivalent, or be recommended by the Director of the Laboratory, subject to approval of the Degrees Committee. He must give evidence of ability to do advanced work in Aquatic Biology and must meet the prerequisites of courses to be taken. Both the application for admission to graduate instruction and the program proposed must have the approval of the Chairman of the Degrees Com-



Chemical Analyses Are Made of the Bay Waters

mittee, the Head of the Department of Biology, and the Director of the Virginia Fisheries Laboratory.

Residence: A minimum residence period of one regular session or of four summer sessions of nine weeks each is required.

Credit: Courses acceptable for graduate credit in Aquatic Biology are those numbered 300, 400, and 500. Students are advised to select a balanced course of study, including fundamental courses in Chemistry, Physics, and Mathematics.

Thesis: In addition to the twenty-four semester credits in advanced courses, an approved thesis is required. Besides demonstrating ability to conduct independent research, the thesis should represent a contribution to existing knowledge of Aquatic Biology. In addition to course examinations, a written and an oral examination are required of all candidates for the degree of Master of Arts. These examinations may include any work submitted by the candidate to fill the requirements for the degree.

DESCRIPTION OF COURSES OF THE SEQUENCE IN AQUATIC BIOLOGY

BIOLOGY 100—**Biological Science.** *Year Course. Lectures three hours, laboratory four hours; ten credits.* Credits determined on an examination given at the end of the year on work of the entire course. Also offered in Summer School.

An introduction to all aspects of biological science including Botany, Zoology, and Psychology. This course satisfies prerequisites of Botany and Zoology for later courses.

BIOLOGY 201—**Comparative Anatomy of Vertebrates.** Prerequisite: Zoology. *First semester; lectures two hours, laboratory six hours; four credits.* Also offered in Summer School.

This course takes up, in a comparative way, the structure of vertebrate animals. A number of types are dissected in the laboratory.

BIOLOGY 202—**Embryology of Vertebrates.** Prerequisite: Comparative Anatomy of Vertebrates. *Second semester; lectures two hours, laboratory six hours; four credits.*

The work of this course is based on the study of the development of the chick with comparative treatment of other forms.

BIOLOGY 301—**Bacteriology and Public Health.** Prerequisites: Zoology or Botany, and General Chemistry. *First semester; lectures three hours, laboratory four hours; four credits.*

Methods of promoting personal, school, and community health, with consideration of some of the fact and theory on which current practice is based. Elementary bacteriological technique, sanitary bacteriology, public health entomology, blood examination, physical inspection, and observation trips.

BIOLOGY 302—**Bacteriology.** Prerequisite: Public Health. It will be advantageous to have taken, or to take with this course Organic Chemistry. *Second semester; lectures two hours, laboratory six hours; four credits.*

Forms, activities, relationships, and cultivation of bacteria, yeasts, and molds, and their economic, industrial, and hygienic significance.

BIOLOGY 304—**Human Physiology.** Prerequisite: Zoology and General Chemistry. It will be advantageous to have taken, or to take with this course, Comparative Anatomy of Vertebrates, Organic Chemistry, and Physics. *Second semester; lectures three hours, laboratory four hours; four credits.*

A study of the properties of the tissues, organs, and systems that make up the animal body, including specific consideration of the physiological effects of exercise. Amphibians and mammals are used in the laboratory work.

BIOLOGY 307—**Histological Technique.** Prerequisite: Comparative Anatomy of Vertebrates. *First semester; lectures one hour, laboratory six hours; three credits.*

Preparation and study of representative tissues of lower vertebrate animals.

Biology 312—**Animal Ecology.** Prerequisite: Zoology. It will be advantageous to have taken Entomology. *Second semester; lectures three hours, laboratory and field work, four hours; four credits.*

The relationship of animals to their environments, including structural and functional adaptations of forms to their habitats, natural factors affecting the scarcity or abundance of species, general principles of geographical distribution. In the field work emphasis is placed upon common local forms, especially arthropods.

Biology 315—**Invertebrate Zoology.** Prerequisite: Zoology. *First semester; lectures two hours, laboratory six hours; four credits.*

A study of life history, structure and classification of invertebrate animals (omitting insects).

Biology 316—**Hydrobiology.** Prerequisite: Botany and Zoology. *Second semester; lectures two hours; laboratory six hours; four credits.*

Biotic, physical and chemical factors of the aquatic environment including certain fundamental principles of oceanography. Special attention is given to Chesapeake Bay conditions.

Oyster Experiments Are Conducted in the Laboratory

Biology—405—**Economic Marine Invertebrates.** Prerequisite: Botany and Zoology. *First semester; lectures two hours, laboratory six hours; four credits.*

The anatomy, life history, propagation and conservation of marine invertebrates of commercial value. Food cycles, methods of population analysis, fishing trends and cultural methods are stressed. Field observations are made on the methods of capture and of packing employed in the fishing industries of Virginia.

Biology 406—**Fishery Biology.** Prerequisites: Botany and Zoology, and Comparative Anatomy of Vertebrates. *Second semester; lectures two hours, laboratory three hours; three credits.*

The anatomy, classification, life history, migration, growth and feeding habits of fishes. Marine and fresh water fishes of Virginia are emphasized.

SUMMER SESSION COURSES IN AQUATIC BIOLOGY

Summer school courses of instruction and research are offered by the Virginia Fisheries Laboratory in cooperation with the Departments of Biology and Chemistry. The normal load for the first 32 days ending Tuesday, July 21st, is six semester hours. Students continuing Biology 342 or 443 until August 7th may receive additional credit.

Biology 241—**Comparative Anatomy of Vertebrates.** *Four semester hours. Prerequisite: four semester hours of Zoology. First term.*

This course takes up, in comparative fashion, the structure of vertebrate animals. A number of types are dissected in the laboratory.

Mr. Ash.

Biology 342—**Flowering Plants of Tidewater Virginia.** *Three semester hours. Prerequisite: four semester hours of Botany. First term.*

A study of the chief groups of flowering plants and of their distribution in Tidewater Virginia. Special emphasis is placed on the aquatic plants of the tidal marshes, including grasses and sedges. Students are expected to prepare an herbarium. Study of individual problems is encouraged.

Mr. Delisle.

Biology 443—**Aquatic Biology and Conservation.** *Three semester hours. Prerequisite: eight semester hours of Biology. First term.*

Fresh, brackish and salt water animals are studied, attention being given to their habitat relations, their source of food and their direct or indirect economic importance. Conservation practices are studied in their relation to local oyster, crab and shad fisheries.

Mr. Hopkins.

BIOLOGY 541—**Research.** *Credits to be arranged. Prerequisite: graduate standing in Biology. Both terms.*

Training in research methods is offered to advanced students in the fields of hydrobiology and conservation and is particularly for those whose research leads to the degree of Master of Arts. Staff.

BIOLOGY 542—**Graduate Seminar.** *Credits to be arranged. Prerequisite: graduate standing in Biology. Both terms.*

Students are given reading and field observation assignments. Round-table discussions of these assignments are held weekly. Staff.

CHEMISTRY 541—**Problems in Analytical Chemistry.** *Credit to be arranged. Prerequisite: graduate standing, and fourteen semester hours of Chemistry. Both terms.*

This course includes study of chemical and physical methods used in the analysis of sea water. It is intended mainly for advanced students in Aquatic Biology. Mr. Armstrong.

COOPERATION WITH OTHER INSTITUTIONS

The Virginia Fisheries Laboratory desires to cooperate in the fullest manner possible with other organizations working in fields related to its own.

United States Fish and Wildlife Service.

The Division of Fishery Biology of this Service has an interest in oyster and finfish problems of Virginia waters. For several years, the Service participated with the Virginia Commission of Fisheries in maintaining a laboratory for the investigation of certain local problems. During the coming year, the cooperative effort will center on problems pertaining to the crab and shad fisheries.

The Craney Island Laboratory of the National Institute of Health.

This Laboratory conducts intensive researches on the bacterial flora of the Hampton Roads area of the Chesapeake Bay. The problems there are being attacked from a broad hydrographic viewpoint, and are intimately related to those being investigated in the Yorktown area.

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1941

Announcement of the

College of William and Mary and Commission of Fisheries in Virginia

Virginia Fisheries Laboratory

Teaching and Research Programs in Aquatic Biology

Official Publication of the College of William and Mary in Virginia

Williamsburg, Virginia
February, 1941

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MAY 4 1949
UNIVERSITY OF ILLINOIS

Calendar 1941 Summer Session

Registration ..... Thursday, June 19th

Lectures begin ..... Friday, June 20th

Holiday ..... Friday, July 4th

Six-week period ends ..... Friday, August 1st

Summer Session ends ..... 3:00 P. M., Friday, August 22nd

Convocation ..... 8:00 P. M., Friday, August 22nd

FIELD TRIPS

York River to study estuarine conditions ..... June 21st

James River to view historic sites ..... June 28th

York River to study oyster rocks ..... July 5th

Boat trip on the James to visit historical monuments ..... July 12th

Ecological trip to the Shenandoah National Park to observe natural areas ..... July 19th

Hampton Roads to observe the commercial crab fishery ..... July 26th

Boat trip to Craney Island to see the work in progress at the National Institute of Health ..... August 2nd

Ecological trip to the George Washington National Forest to study biotic communities ..... August 9th

Intertidal Communities on Mobjack Bay to study their composition and distribution ..... August 16th

Virginia Fisheries Laboratory

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John Stewart Bryan.....*President of the College*
G. Walter Mapp*.....*Commissioner of Fisheries of Virginia*
J. Brooks Mapp†.....*Commissioner of Fisheries of Virginia*
Charles J. Duke, Jr.....*Bursar of the College*
James W. Miller.....*Dean of the Faculty*
Kremer J. Hoke.....*Dean of the Summer School*

COOPERATING INSTITUTIONS

College of William and Mary
Commission of Fisheries of Virginia
U. S. Fish and Wildlife Service

EXECUTIVE COMMITTEE

Donald W. Davis, *Chairman*
G. Walter Mapp* J. Brooks Mapp Elmer H. Higgins

ADVISORY BOARD

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Paul S. Conger, *Research Associate,* Carnegie Institution of Washington.
J. S. Darling, of the firm of J. S. Darling & Son, Hampton, Virginia.
Donald W. Davis, *Professor of Biology,* College of William and Mary
Paul S. Galtsoff, *In Charge of Oyster Investigations,* U. S. Fish and Wildlife Service
Elmer H. Higgins, *Chief,* Division of Fishery Biology, U. S. Fish and Wildlife Service.

*Died February 2nd, 1941.
†Took office February 19th, 1941.

Washington Hall, Housing the Department of Biology, From the Sunken Garden

George W. Jeffers, *President-elect*, Virginia Academy of Science.
Ivey F. Lewis, *Miller Professor of Biology*, University of Virginia.
G. Walter Mapp,* *Commissioner*, Commission of Fisheries of Virginia.
J. Brooks Mapp, *Commissioner*, Commission of Fisheries of Virginia.
S. O. Mast, *Professor of Zoology*, The Johns Hopkins University.
R. L. Miles, of the firm of J. H. Miles & Company, Norfolk, Virginia.
Thurlow C. Nelson, Professor of Zoology, Rutgers University.
Carl H. Nolting, *Chairman*, Commission of Game and Inland Fisheries of Virginia.
I. C. Riggin, *Commissioner*, Virginia Board of Health.
N. Clarence Smith, *Commissioner*, Virginia Commission of Conservation.
Thomas B. Symons, *Dean*, College of Agriculture, University of Maryland.
A. J. Wimbrow, of the firm of A. J. Wimbrow & Brother, Chincoteague, Virginia.

*Died February 2nd, 1941.

Waiting for the Tide: Pound Net Fishermen

Virginia Fisheries Laboratory

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Lecturer in Biology, College of William and Mary
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ALFRED R. ARMSTRONG, M.A.....*Research Associate*
Assistant Professor of Chemistry, College of William and Mary
ROY P. ASH, Ph.D.....*Research Associate*
Assistant Professor of Biology, College of William and Mary
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Assistant Professor of Biology, College of William and Mary
WINSTON MENZEL, B.S.....*Research Assistant*
B. B. SHEPHERD, M. A.....*Research Assistant*
Graduate Assistant, College of William and Mary
J. REVELL MELSON.....*Demonstrator*
ELIZABETH J. WAKEMAN.....*Laboratory Assistant*
EMMA E. BOURQUIN.....*Laboratory Assistant*
HERBERT A. DRUMMOND.....*In Command of the "Agnes Hope"*
L. T. KILLMAN.....*Engineer of the "Agnes Hope"*

FACULTY

ALFRED R. ARMSTRONG, M. A.....*Assistant Professor of Chemistry*
College of William and Mary
ROY P. ASH, Ph.D.....*Assistant Professor of Biology*
College of William and Mary
DONALD W. DAVIS, Ph.D. *Professor and Head Department of Biology*
College of William and Mary
ALBERT L. DELISLE, Ph.D.....*Assistant Professor of Biology*
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Texas A. & M. College.
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University of Illinois
CURTIS L. NEWCOMBE. Ph.D.....*Associate Professor of Biology*
College of William and Mary

Virginia Fisheries Laboratory

"If the seasons of husbandry be not interfered with,
The grain will be more than can be eaten,
If close nets are not allowed to enter the pools and ponds,
The fish and turtles will be more than can be consumed."
—by the Chinese philosopher, Mencius, about 325 B. C.

With the object of conserving and developing the aquatic resources of Virginia, the Virginia Fisheries Laboratory was established in 1940 under authority of the General Assembly. Funds were appropriated for this work, in part through the Virginia Commission of Fisheries and in part through the College of William and Mary. A program of research and instruction in Aquatic Biology and conservation is carried on by the Laboratory in cooperation with the College. Field studies are centered at the laboratory in Yorktown; teaching work is conducted in Williamsburg; and experimental work is carried on in both locations. The United States Fish and Wildlife Service cooperates in the program.

FUNCTION

The Virginia Fisheries Laboratory functions as a service institution aiming to contribute information that will directly assist the commercial fisheries of tidewater Virginia. To this end, the Laboratory conducts biological surveys of the quantity and the distribution of certain forms that compose our more important tidewater fisheries. These organisms are further studied to determine the best way in which they may be cultivated and utilized by industry. Animals whose life histories are unknown or only partly understood are receiving immediate attention to provide a fundamental basis for scientific fishery management.

The Laboratory also aims to measure the environmental factors affecting distribution and fluctuations in abundance of important economic forms recognizing that nature as well as man, affects the potential yield of a fishery. Physical, chemical and biological conditions are studied in relation to the productivity of the waters of the region.

A third objective of the program is to raise the general level of understanding and appreciation of seafood products, to provide a source of information through laboratory and field study

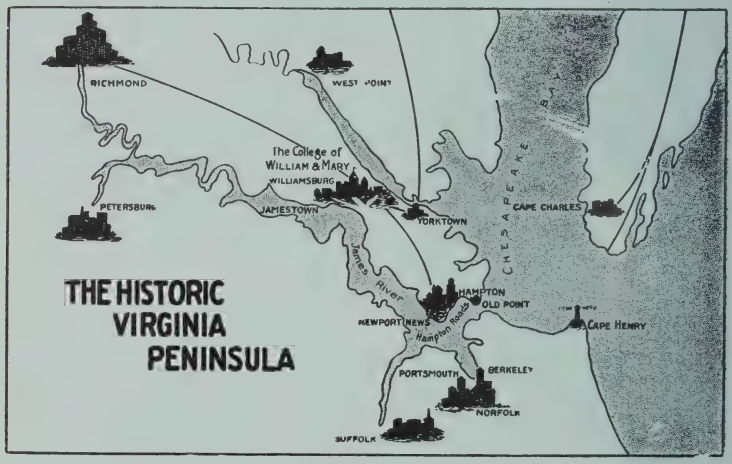
that will constitute a basis for the cultivation and wise-utilization of aquatic resources, and lastly, to train students in those fundamental and applied phases of biology that will enable them to continue this program.

LOCATION

Williamsburg and Yorktown, with Jamestown the cradle of Anglo-Saxon civilization in America, are located in a section of America rich in memories of a pioneer culture. Williamsburg has a population of about 4,000 and is situated six miles from Jamestown and 15 miles from Yorktown. The College of William and Mary in Virginia was founded here in 1693, and shortly thereafter (1699) Williamsburg became the Colonial Capital. During the last decade, the historic city of the middle 18th century has been restored and it is now the most extensive and most perfect work of restoration in America. Yorktown, with a population of about 500, is situated on the York River within 7 miles of the deeper waters of the Chesapeake Bay.

Digging for Clams

Being located on the peninsula between the James and York Rivers, the Virginia Fisheries Laboratory is within easy reach of the less saline waters of the James and the denser waters of the York, and is also within short cruising range of the great Chesapeake Bay and oceanic conditions beyond Capes Charles and Henry. Few locations rival the region in respect to range and types of water conditions and the accompanying characteristic faunal and floral transitions. The historic and scenic beauties add to its attractiveness as a place in which to carry on aquatic studies.



"Heaven and Earth never agreed better
to frame a place for man's habitation".
—*by Captain John Smith.*

THE PROGRAM IN AQUATIC BIOLOGY

The general program in Aquatic Biology presented on pages 19 and 20 offers to undergraduate students an opportunity for getting sufficient training in applied biology to qualify for a position or to prepare for graduate study. Students who have satisfactorily completed their undergraduate requirements may candidate for graduate study in Aquatic Biology leading toward the degree of Master of Arts. Candidates for this degree are encouraged to spend one summer in residence for the purpose of gaining an adequate amount of field experience with special reference to their thesis work, and also, to permit their taking

Oyster Tongers at Work

Biology 443—Aquatic Biology and Conservation. In the summer session, courses numbered between 300 and 500 are for advanced undergraduates and graduates; those numbered 500 and above are for students having graduate standing. A student may enroll during the six weeks session for two courses, carrying a maximum total of eight semester credits. Those conducting research may continue during the succeeding three weeks and receive credit commensurate with the work. Students who require only one course in the general field of biology may, if desired, select additional work in other departments in accordance with their special needs. Summer courses in the Aquatic Biology program carry credit toward the A. B., B. S., and M. A. degrees and toward teachers' certificates.

Special encouragement and assistance are given to high school teachers of Virginia to aid them in interesting their students in the biology and the preservation of local forms. To this end, a marine biological exhibit is maintained at the Yorktown laboratory throughout the year. Demonstration material illustrating the biology of local marine forms is made available to the principal high schools of the region. Teachers of biology who wish to

do graduate work in this field may, during four summers of residence, complete requirements for the degree of Master of Arts.

The *teaching program* during both winter and summer emphasizes the broad aspects of conservation and applied ecology, much time being spent out-of-doors. Biology 443 provides special training in the essentials of field study. The field observations include the identification of different biotic communities including the characteristic animals and plants of which they are composed; the study of local marine forms in the Chesapeake Bay; and, also, the biology of important commercial forms upon which the fishery industries of the Chesapeake Bay depend.

The *research program* in Aquatic Biology includes a biological survey of the tidal waters of Virginia with special reference to the conservation of shellfish. Specific studies are in progress on the oyster, the mussel, the clam, and the blue crab. Basic conditions affecting the productivity of the Bay waters, such as the distribution of dissolved oxygen and of nutrient substances, are also being investigated.

The whole program is built around one essential objective, namely, to further the understanding of the economy of nature in Virginia tidewaters, what it means to those now reaping its benefits, and what it may mean to those who will inherit it.

FACILITIES FOR FIELD AND LABORATORY STUDY

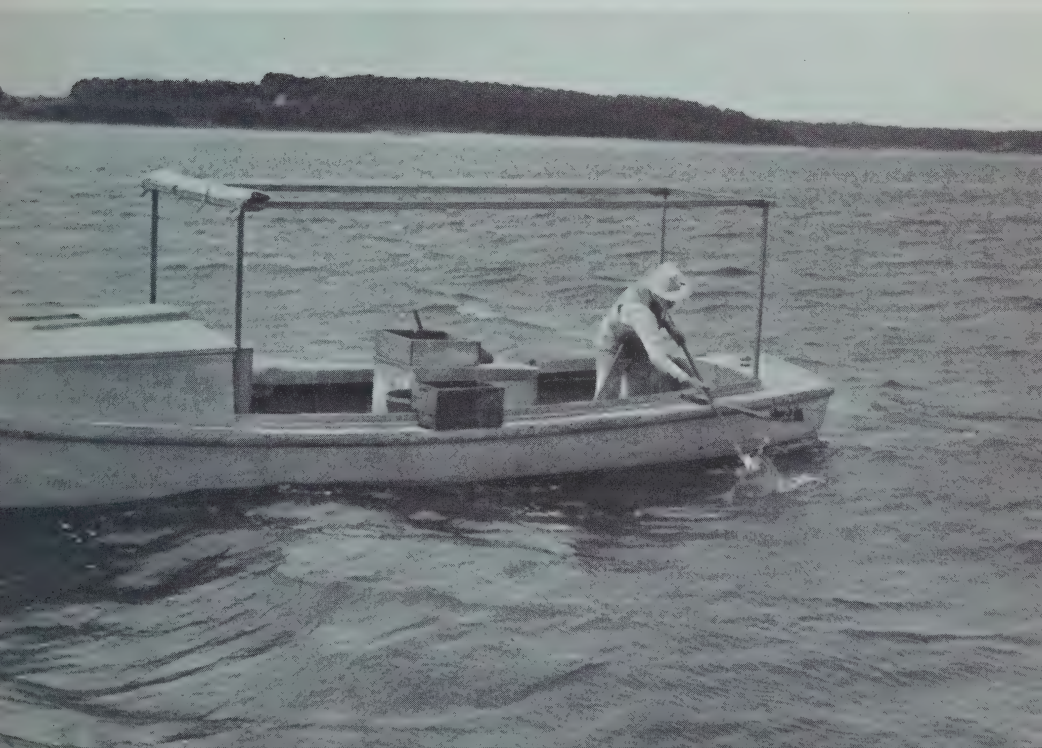
The Virginia Fisheries Laboratory is well located to function as a center for the investigation of tidewater problems in fishery biology. It is beside typical estuarine waters of lower Chesapeake Bay and within easy reach of off-shore oceanic conditions. The variety of gradients in respect to physical and chemical factors and the accompanying animal and plant populations occupying strata of rapidly changing conditions, present a series of intriguing problems to the naturalist and to the experimentalist. The "Agnes Hope", a 45-foot motor boat, is used for off-shore studies. This boat carries an outboard motor boat for studies in shallow areas and facilities for limited types of physical and chemical determinations. Standard oceanographic sampling equipment for studying plankton populations, submarine illumination, and nutrient salts is carried. A smaller power boat is

used for local studies, and routine river collecting is done in an outboard motor boat.

The field station at Yorktown serves for experimental studies, chiefly those which require running salt water. It is equipped with gas and electricity, running salt and fresh water, and, also, numerous large and small aquaria. Arrangements are made for the provision of additional supplies when needed from laboratories in Williamsburg.

Field work of the teaching program, conducted mainly in Williamsburg, is done on the nearby rivers and Bay and in the wildlife sanctuary called Matoaka Park, that adjoins the College campus. This nature center contains 1,200 acres of natural scenic attraction surrounding the waters of Lake Matoaka. During the summer, rather extensive field trips are to be taken to fish and crab packing centers on the Bay in order that students may learn how the Bay products of commerce are handled. Excursions to the Shenandoah National Park and the George Washington National Forest are contemplated during the sum-

Trot Line Crab Fisherman in Action



mer of 1941; and, also, to the Swift Creek Recreational Demonstration Area near Richmond where students will be given an introduction to the course of training for nature leaders offered there.

Research facilities are provided in the scientific departments of the College. These include standard histological equipment, temperature control units, spectrophotometers for colorimetric work, a submarine photometer, and standard chemicals.

The College library is well supplied with standard works on Biology. Certain periodicals not available on the campus may be borrowed directly from the library of the United States Fish and Wildlife Service in Washington, or through the inter-library loan service.

FAUNA OF THE REGION

The variety of animal life in the estuarine waters of the lower Bay is expectedly large. Typical oceanic forms are present on the sea-side while brackish water organisms characterize the estuarine waters of the Bay. Local invertebrates for taxonomic, embryological and experimental study include *Microciona, Thuiaria, Bougainvillia, Hydractinia, Nemopsis, Dactylometra, Mnemiopsis, Pleurobrachia, Sagitta, Bugula, Alcyonidium, Leoidonotus, Polydora, Nereis, Arenicola, Cerebratulus, Acartia, Calanus, Balanus, Corophium, Batea, Caprella, Erichthonium, Idothea, Neomysis, Chloridella, Callinectes, Palaemonetes, Crago, Panopeus, Eurypanopeus, Uca, Libinia, Limulus, Asterias, Echinarachnius, Thyone, Arbacia, Littorina, Nassarius, Venus, Ostrea, Mya,* and *Volsella.* Among the lower chordates, *Balanoglossus,* and *Molgula* occur. For information on the fishes occurring in Chesapeake Bay reference is made to "The Fishes of Chesapeake Bay" by Hildebrand and Schroeder.

In view of the different salinity gradients ranging from oceanic to fresh water conditions of the upper James and York rivers or of the upper reaches of the Chesapeake Bay, many interesting phenomena of distribution occur. They present numerous problems which need study.

Returning from a Collecting Trip on Chesapeake Bay

RESEARCH ACCOMMODATIONS FOR GUEST INVESTIGATORS

Guest investigators may be admitted to the Laboratory and given use of available facilities for their research. They should send to the Director a statement concerning their proposed research problem and the equipment that will be required. Persons unknown to the Director should submit with their application a statement of their qualifications and references.

ADMISSION

Students should consult the Annual College Catalogue or the Bulletin of the Summer Session for information regarding admission. Those desiring to take one or more of the courses offered by the Laboratory should communicate with the Dean of the Summer School relative to credentials for admission, and to the Director of the Laboratory for information about the courses and problem work desired.

EXPENSES FOR SUMMER SESSION

Room Rent: The rent in Jefferson, Barrett and Monroe Halls is as follows: Two persons in double room without bath, each person $12.00 for six weeks; $18.00 for nine weeks. Two persons in double room with connecting bath, each person $15.00 for six weeks; $22.50 for nine weeks. Two persons in double room with private bath, each person $18.00 for six weeks; $27.00 for nine weeks. No single rooms are available. The dormitories will be open at 12:00 noon, Wednesday, June 18th. The dining hall will be open Thursday, June 19th. Meals in dining hall, $6.00 per week. Single meals 50c.

	Virginia Teachers		Other Virginia Students		Students from Other States	
	6-week	9-week	6-week	9-week	6-week	9-week
Matriculation	$15.00	$22.50	$15.00	$22.50	$15.00	$22.50
Tuition			10.00	15.00	20.00	30.00
Student fee (medical and recreational)	.50	.50	.50	.50	.50	.50

Additional Fees: A laboratory fee of $5.00 is charged for each three or four semester-hour course in biology, physics and chemistry.

A fee of $5.00 will be charged for each course of two semester hours carried above a total of six semester hours per term of six weeks or $7.50 above a total of nine semester hours per term of nine weeks.

The College runs a first class laundry where students may receive laundry service for $4.00 per term of six weeks or $6.00 per term of nine weeks.

TRANSPORTATION

Williamsburg and Yorktown may be reached by bus or rail from Richmond. Baltimore boats stop at Yorktown. A schedule may be obtained by addressing the Chesapeake Steamship Company, Yorktown.

CURRICULUM FOR STUDENTS

Concentrating in Aquatic Biology

Students of Aquatic Biology need training in the basic sciences. The sequence below meets this consideration and offers students of Arts and Sciences a course of study that will equip them to apply their undergraduate training in natural history, wildlife management and conservation, fishery biology, and related fields. Also, it provides a scientific background for post-graduate study in one or more special branches of biology.

Freshman Year

	Semester Credits	
	First	*Second*
English 100	3	3
Mathematics 101-102	3	3
Biology 100	5	5
Chemistry 100	5	5
Physical Ed. 101-102	1	1
	17	17

Sophomore Year

	Semester Credits	
	First	*Second*
*English	3	3
Chemistry 201-202	4	4
†Biology 201-304	4	4
French or German	3	3
Physical Ed. 201-202	1	1
	15	15

Junior Year

Biology 315-316	4	4
Economics, or Government, or History	3	3
French or German	3	3
Physics 101-102	5	5
	15	15

Senior Year

Biology 405, 406	4	4
Biology 307, 312	3	4
Economics, or Government, or History	3	3
French or German	3	3
Electives (to make a total of 124)	2	1
	15	15

*Further specifications of requirements in departments where numbered courses are not here indicated and the description of the numbered courses in departments other than Biology (which see below) are given in the annual College catalogue supplied on request by the Registrar, College of William and Mary, Williamsburg, Virginia.

†Graduate credit may be received for three and four hundred courses with consent of the Head of the Department of Biology.

REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

The College of William and Mary offers the degree of Master of Arts to students majoring in Aquatic Biology who have creditably met the requirements stated below:

Entrance: The applicant for graduate instruction in Aquatic Biology must have completed the requirement for a bachelor's degree in an institution of approved standing; and must have made a quality point average of 4.5 or its equivalent, or be recommended by the head of the department in which he wishes to do his major work subject to approval of the Degrees Committee. He must give evidence of ability to do advanced work in Aquatic Biology and must meet the prerequisites of courses to be taken. Both the application for admission to graduate instruction and the program proposed must have the approval of the Chairman of the Degrees Committee, the Head of the Department of Biology, and the Director of the Virginia Fisheries Laboratory.

Residence: A minimum residence period of one regular session or of four summer sessions of nine weeks each is required.

Credit: Courses acceptable for graduate credit in Aquatic Biology are those numbered 300, 400, and 500. Students are advised to select a balanced course of study, including fundamental courses in Chemistry, Physics, and Mathematics.

Thesis: In addition to the twenty-four semester credits in advanced courses, an approved thesis is required. Besides demonstrating ability to conduct independent research, the thesis should represent a contribution to existing knowlege of Aquatic Biology. In addition to course examinations, a written and an oral examination are required of all candidates for the degree of Master of Arts. These examinations may include any work submitted by the candidate to fill the requirements for the degree.

DESCRIPTION OF COURSES OF THE SEQUENCE IN AQUATIC BIOLOGY

Biology 100—**Biological Science.** *Year Course. Lectures three hours, laboratory four hours; ten credits.* Credits determined on an examination given at the end of the year on work of the entire course. Also offered in Summer School.

An introduction to all aspects of biological science including Botany, Zoology, and Psychology. This course satisfies prerequisites of Botany and Zoology for later courses.

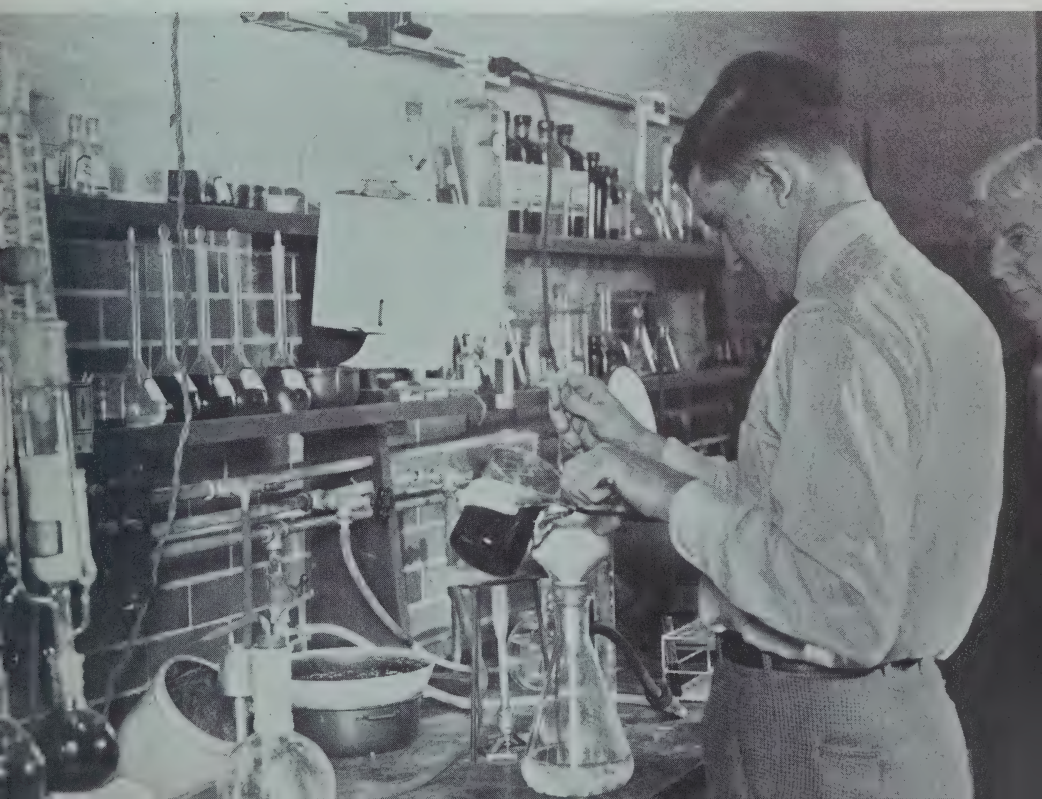
Biology 201—**Comparative Anatomy of Vertebrates.** Prerequisite: Zoology. *First semester; lectures two hours, laboratory six hours; four credits.* Also offered in Summer School.

This course takes up, in a comparative way, the structure of vertebrate animals. A number of types are dissected in the laboratory.

Biology 202—**Embryology of Vertebrates.** Prerequisite: Comparative Anatomy of Vertebrates. *Second semester; lectures two hours, laboratory six hours; four credits.*

The work of this course is based on the study of the development of the chick with comparative treatment of other forms.

Chemical Analyses Are Made of the Bay Waters



Biology 301—**Bacteriology and Public Health.** Prerequisites: Zoology or Botany, and General Chemistry. *First semester; lectures three huors, laboratory four hours; four credits.*

Methods of promoting personal, school, and community health, with consideration of some of the fact and theory on which current practice is based. Elementary bacteriological technique, sanitary bacteriology, public health entomology, blood examination, physical inspection, and observation trips.

Biology 302—**Bacteriology.** Prerequisite: Public Health. It will be advantageous to have taken, or to take with this course Organic Chemistry. *Second semester; lectures two hours, laboratory six hours; four credits.*

Forms, activities, relationships, and cultivation of bacteria, yeasts, and molds, and their economic, industrial, and hygienic significance.

Biology 304—**Human Physiology.** Prerequisite: Zoology and General Chemistry. It will be advantageous to have taken, or to take with this course, Comparative Anatomy of Vertebrates, Organic Chemistry, and Physics. *Second semester; lectures three hours, laboratory four hours; four credits.*

A study of the properties of the tissues, organs, and systems that make up the animal body, including specific consideration of the physiological effects of exercise. Amphibians and mammals are used in the laboratory work.

Biology 307—**Histological Technique.** Prerequisite: Comparative Anatomy of Vertebrates. *First semester; lectures one hours, laboratory six hours; three credits.*

Preparation and study of representative tissues of lower vertebrate animals.

Biology 312—**Animal Ecology.** Prerequisite: Zoology. It will be advantageous to have taken Entomology. *Second semester; lectures three hours, laboratory and field work, four hours; four credits.*

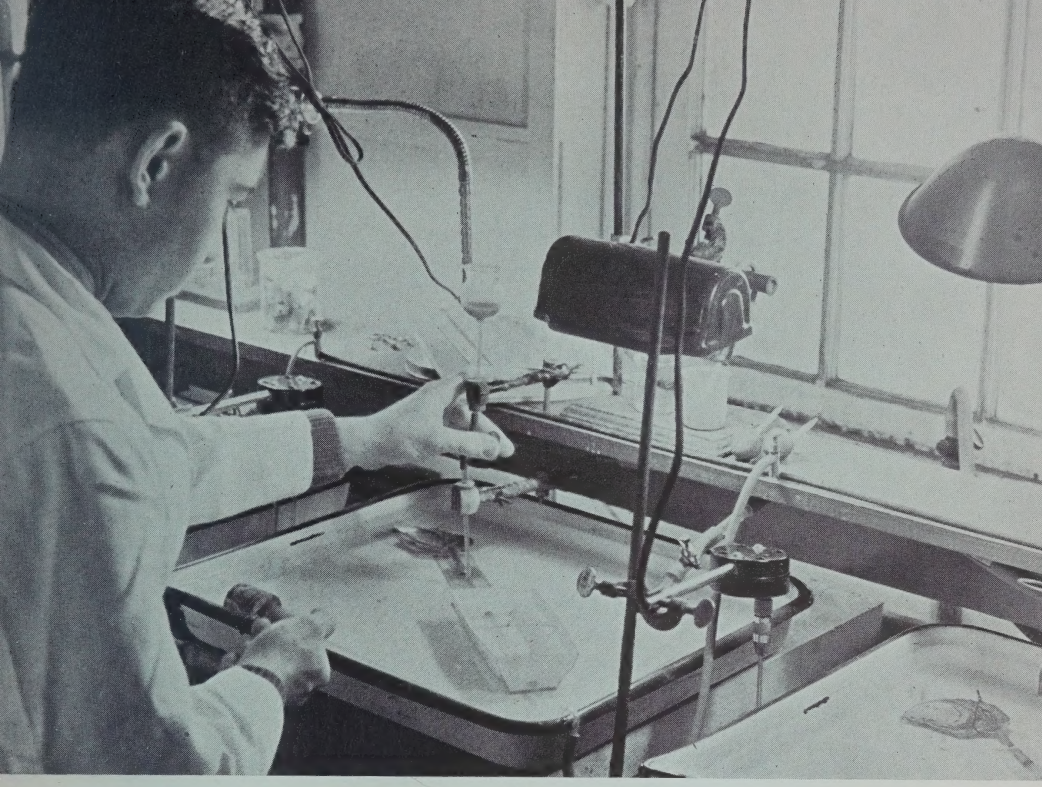
The relationship of animals to their environments, including structural and functional adaptations of forms to their habitats, natural factors affecting the scarcity or abundance of species, general principles of geographical distribution. In the field work emphasis is placed upon common local forms, especially arthropods.

Biology 315—**Invertebrate Zoology.** Prerequisite: Zoology. *First semester; lectures two hours, laboratory six hours; four credits.*

A study of life history, structure and classification of invertebrate animals (omitting insects).

Biology 316—**Hydrobiology.** Prerequisite: Botany and Zoology. *Second semester; lectures two hours; laboratory six hours; four credits.*

Biotic, physical and chemical factors of the aquatic environment including certain fundamental principles of oceanography. Special attention is given to Chesapeake Bay conditions.



OYSTER EXPERIMENTS ARE CONDUCTED IN THE LABORATORY

BIOLOGY 405—**Economic Marine Invertebrates.** Prerequisite: Botany and Zoology. *First semester; lectures two hours, laboratory six hours; four credits.*

The anatomy, life history, propagation and conservation of marine invertebrates of commercial value. Food cycles, methods of population analysis, fishing trends and cultural methods are stressed. Field observations are made on the methods of capture and of packing employed in the fishing industries of Virginia.

BIOLOGY 406—**Fishery Biology.** Prerequisites: Botany and Zoology, and Comparative Anatomy of Vertebrates. *Second semester; lectures two hours, laboratory three hours; three credits.*

The anatomy, classification, life history, migration, growth and feeding habits of fishes. Marine and fresh water fishes of Virginia are emphasized.

SUMMER SESSION COURSES IN AQUATIC BIOLOGY

Special courses of instruction and research in the fields of hydrobiology and conservation offered by the Virginia Fisheries Laboratory during the summer session are described here.

BIOLOGY 241—**Comparative Anatomy of Vertebrates.** *Four semester hours. Prerequisite: Four semester hours of Zoology.*

This course takes up, in a comparative way, the structure of vertebrate animals. A number of types are dissected in the laboratory.
Mr. ————

BIOLOGY 341—**Invertebrate Zoology.** *Three semester hours. Prerequisite: four semester hours of Zoology.*

A study of the life history, structure and classification of invertebrate animals. Field studies include observations on the biology of important Chesapeake Bay forms. Mr. Hopkins.

BIOLOGY 443—**Aquatic Biology and Conservation.** *Three semester hours. Prerequisite: eight semester hours of Biology.*

An ecological study of aquatic and terrestrial habitats with special reference to plants and animals in their adjustment to their environment and to problems of their conservation and management. Field trips to the Shenandoah National Park and the George Washington National Forest are planned. Mr. Kendeigh.

BIOLOGY 444—**Algae.** *Three semester hours. Prerequisite: Four semester hours of Botany.* (Not offered in 1941).

Lectures, laboratory and field studies of local representative forms of fresh-water and marine algae. Emphasis is placed on the phytoplankton of Chesapeake Bay. Students become acquainted with the common types of algae, the methods of collecting, preserving, and identifying them. Mr. Delisle.

BIOLOGY 541—**Research.** *Credit to be arranged. Prerequisite: graduate standing in Biology.*

Training in research methods is offered to advanced students in the fields of hydrobiology and conservation and is particularly for those whose research leads to the degree of Master of Arts. Staff.

BIOLOGY 542—**Graduate Seminar.** *Credit to be arranged. Prerequisite: graduate standing in Biology.*

Students are given reading and field observation assignments. Round-table discussions of these assignments are held weekly. Staff.

CHEMISTRY 541—**Problems in Analytical Chemistry.** *Credit to be arranged. Prerequisite: graduate standing, and fourteen semester hours of Chemistry.*

This course includes study of chemical and physical methods used in the analysis of sea water. It is intended mainly for advanced students in Aquatic Biology. Mr. Armstrong.

COOPERATION WITH OTHER INSTITUTIONS

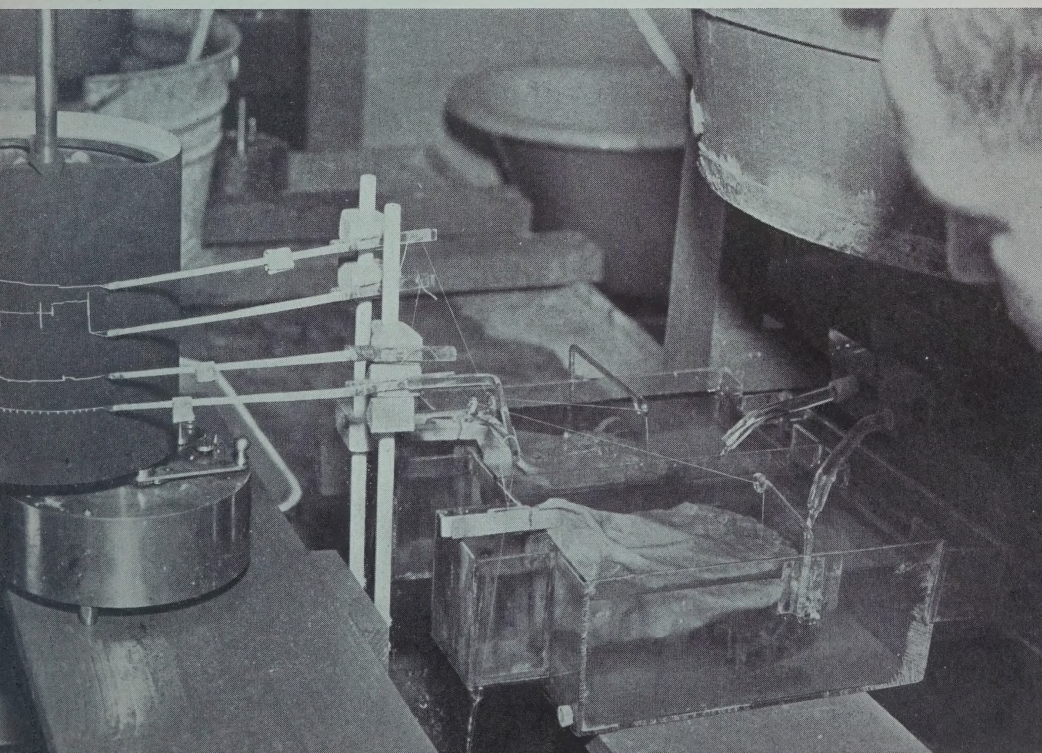
The Virginia Fisheries Laboratory desires to cooperate in the fullest manner possible with other organizations working in fields related to its own. To this end it has offered its facilities to the

following nearby institutions and is glad to take advantage of their generous offers of cooperation:

The Craney Island Laboratory of the National Institute of Health.

This Laboratory conducts intensive researches on the bacterial flora of the Hampton Roads area of the Chesapeake Bay. The problems there are being attacked from a broad hydrographic viewpoint, and are intimately related to those being investigated in the Yorktown area.

The Virginia Natural History Institute.

This Institute conducts a training course for nature leaders at Swift Creek Recreational Demonstration Area near Richmond. Such leaders are in demand for State and National Parks and by educational and recreational agencies. It is expected that students in the summer session will have opportunity to become acquainted with the work of the Natural History Institute and with the fields that such work opens to them.

Recording the Activities of the Oyster